

Nickel HPAL tailings: the unfolding environmental disaster in Indonesia

More than a billion tonnes of toxic waste will be generated by 2035 and it's already causing problems. What can be done to improve standards and avoid environmental catastrophe?

Reza Rahmaditio and Ian Hiscock | July 2026

JAKARTA (15 July 2026) – Indonesia's nickel HPAL refineries will generate 1.4 billion tonnes of hazardous waste by 2035, according to analysis published today by the Energy Shift Institute (ESI). That is ten times the volume stored today, and enough to cover Jakarta more than a metre deep.

The waste is already killing people. Three collapses at storage sites since March 2025 have killed four workers, and that is at today's volume, which is a tenth of what is coming.

If the plants now planned and under construction go ahead, this single industry will soon be producing more waste each year than every other mine in Indonesia reported to the government combined. Its first plant only opened in 2021.

The waste comes from High Pressure Acid Leach ('HPAL') plants, the technology that makes it possible to turn low-grade nickel ore into a high-value product. But it leaves behind more than 100 tonnes of waste for every tonne of nickel, about twenty times as much as a conventional smelter. The waste, known in the industry as tailings, is a mud-like material, which contains heavy metals and can contaminate water systems.

Unlike conventional mine waste, HPAL tailings are not stored at remote mine sites. They are piled into stacks that grow tens of metres high at industrial parks in Sulawesi and North Maluku – next to villages and the coastal waters where communities fish. The tailings contain between 1 and 1.5 percent chromium, some of it in a water-soluble, carcinogenic form. At projected 2030 volumes, that means 1.4 to 2.0 million tonnes of chromium entering storage every year.

"Indonesia is building the refineries far faster than it is building the places to put the waste," says Reza Rahmaditio, Analyst at the Energy Shift Institute. "The current nickel build-out in Indonesia is like speeding without a seatbelt," says Reza Rahmaditio. "It endangers the people in the car, and the people who happen to be standing by the road."

A stack of dried waste is only safe while it stays dry. Sulawesi and North Maluku get 2,400 to 3,000 mm of rain a year, and it rains four days out of five. These are some of the wettest regions to apply dry stacking as 80 percent of dry stack sites elsewhere receive under 800 mm. When rain soaks back into a stack, the dried cake turns to mud again raising the risk of containment failures.

Speed makes it worse. A nickel refinery in Indonesia can now be built in 16 months. The one waste facility built properly for this material in a wet tropical climate, in New Caledonia, took two years of trials and then three years of construction.

"HPAL refineries in Indonesia are often built faster than the storage facility," says Rahmaditio. "So the facility is poor quality or unfinished when the waste starts arriving."

Indonesia does not regulate nickel waste as its own problem. It sits under general hazardous waste rules, which set requirements according to where the waste is put: into a landfill, down an injection well, back into a mined-out pit, behind a dam, or out to sea. Piling it into a stack is not on the list, and none of the categories that are on the list demand what a stack actually needs.

That gap matters more than it sounds. On paper, a stack is the safer choice. The waste is drier and denser, and there is no reservoir of liquid sitting behind a wall. But the safety is conditional. It has to be earned daily, by drying the waste to the right consistency, packing it down hard, and draining the rain off before it soaks back in. Nothing in Indonesian law requires any of that. Each operator sets its own standard, and practice varies from site to site.

"Stacking is the safer method in theory," says Rahmaditio. "In practice it is only as safe as the operator decides to make it, and Indonesian law never asks the question."

One site in Morowali was reported to have built its drainage for the kind of storm that comes around once every 50 years. That falls well below international standards such as the Global Industry Standard on Tailings Management (GISTM), which requires facilities to withstand a storm expected once in 200 years at minimum. And that minimum is set for the safest sites in the world. Indonesian facilities are nothing like them. They hold far more waste, they sit next to villages and coastal waters, and they operate in a wet tropical climate.

The Morowali industrial park was approved to occupy 2,000 hectares. In June 2025, government investigators found that industrial activities were taking place on about 1,800 hectares outside the area covered by its approved environmental permit (AMDAL), and identified an estimated 12 million tonnes of unpermitted slag and tailings stockpiled on the site.

ESI calls on the government to rationalize the speed and review new HPAL projects. Waste must be regulated according to the harm it would cause if they failed rather than by the method they use. Technical rules for waste stacks must be written that are suited to the unique conditions of Indonesia including rainfall, seismic activity as well as proximity to communities and ecosystems. No new refinery should be allowed to start production until the waste facility is constructed to proper standards, independently checked, and large enough to hold five years of waste.

"This makes the storage facility, not the processing plant, the reference for the pace of project development," says Rahmaditio. "Right now it is the other way around, and that is why storage is being finished in a hurry, or not at all."

ESI estimates that slower development and the cancellation of marginal projects could avoid up to 796 million tonnes of tailings by 2035. Stronger standards would also raise the real cost of storage, which improves the economics of iron recovery. Recycling could keep up to 286 million tonnes out of storage.

"The wave of new HPALs built in Indonesia is a significant achievement. It makes more efficient use of mineral resources and drives down operating costs at industrial parks, boosting Indonesia's international competitiveness. However, proper disposal of tailings is essential to protect communities and ecosystems" says Ian Hiscock, Principal at the Energy Shift Institute. "The problem of HPAL tailings is scaling-up rapidly. Acting quickly and preventively will be far more effective than trying to manage the consequences of poor tailings storage."